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COMMAND and CONTROL TECHNICAL CENTER

WWMCCS ADP OPERATING SYSTEM
TECHNICAL BULLETIN 76OT-35

ESD-TR-76-285

MTR-3313

WWMCCS SYSTEM 700 REMOTE TERMINAL TEST AND DIAGNOSTIC SOFTWARE UTILIZATION

8 OCTOBER 1976

WWMCCS ADP DIRECTORATE
COMMAND AND CONTROL TECHNICAL CENTER
DEFENSE COMMUNICATIONS AGENCY
WASHINGTON, D.C. 20301

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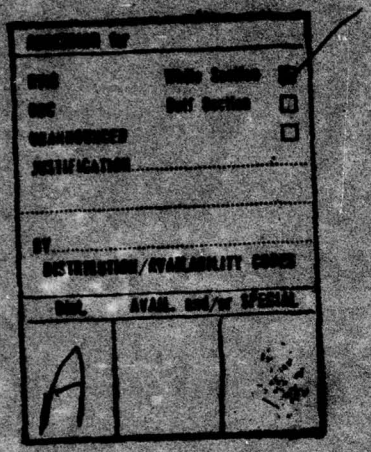

CCTC REVIEW AND APPROVAL

This technical bulletin describes diagnostic routines for the H700. It was produced by the Air Force WWMCCS Program Office, ESD; subsequent revisions will be maintained by the WWMCCS ADP Directorate, CCTC.

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Test and Diagnostic software is supplied under the WWMCCS ADP contract to all System 700 remote terminal installations. This paper describes the content of the off-line programs and provides detailed step-by-step procedures for their utilization in a typical Government/contractor maintenance relationship. This effort was accomplished as part of the WWMCCS Communications Fault Isolation task sponsored by the Air Force WWMCCS Program Office.

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FOREWORD

The Electronic Systems Division, Deputy for Air Force World Wide Military Command and Control Systems (WWMCCS), was tasked by Hq. USAF to develop fault isolation procedures and tools for WWMCCS local-host communications networks. This task involved:

(1) the test and evaluation of communications equipment diagnostic software delivered under the WWMCCS ADP contract,

(2) the test and evaluation of non-standard communications equipment diagnostic features installed on certain WWMCCS networks,

(3) the design and verification of operational procedures for isolating communications network malfunctions, and

(4) the investigation of standard system techniques for detection of communications circuit outages and degraded conditions.

The System 700 is a standard WWMCCS remote terminal. It is normally provided in either of two configurations: as a Remote Batch terminal or as a Remote Network Processor terminal. In either case, an overall communications system fault-isolation procedure must include the capability to determine the operational status of the System 700 hardware. The off-line System 700 Test and Diagnostic software delivered by the WWMCCS ADP contractor, HONEYWELL Information Systems, partially satisfies this requirement. However, because the accompanying documentation is inadequate for Government utilization, it has been necessary to establish the procedures contained herein for airmen operators of the System 700.

Periodic utilization of the diagnostic software and the procedures contained in the report will result in less downtime and increased System 700 availability over the operational life of the system.

This document is formatted such that additional Test and Diagnostic software descriptions and operational procedures can be added as they become available to the WWMCCS community.

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1.0 INTRODUCTION

1.1 Background and Related Activities

This section describes the system aspects of communications fault isolation, the efforts and results that have been accomplished in this area by the project team, and related activities currently in progress.

1.1.1 Relevant ESD/MITRE Task Areas

The Electronic Systems Division, Deputy for Air Force WWMCCS (ESD/WW), with system engineering and technical support from The MITRE Corporation, has been involved in WWMCCS communications fault isolation since July 1974.

The initial activity involved test and verification of the H6000 Communications On-Line Test System (COLTS). At various WWMCCS test sites, the COLTS diagnostics were exercised with the procedures described in the standard system documentation. As a result of this activity, a set of step-by-step procedures were developed for both the operators at the remote terminals and the H6000 operator. These procedures allow the test of the various communications subsystems hardware by individuals with no knowledge of the electronics features of the hardware. The error-detection mechanism is simply the observation of a difference between the test output and the output described in the procedure. The step-by-step procedures will become a WWMCCS standard maintained by the Command and Control Technical Center (CCTC) after the release of GCOS W6.4. Also as a result of this activity, a program was established by the Air Training Command (ATC), the WWMCCS Single Service Training Manager, at the Keesler Technical Training Center to train WWMCCS operators in exercising various diagnostic tests, including COLTS. ESD/WW acted as the Subject Matter Expert in the definition of job-performance requirements for this capability.

A second test-and-verification activity was initiated to verify the System 700 T&D software supplied by the WWMCCS ADP contractor. Use of this software is a critical factor in diagnosing faults on System 700 links and is described in detail in Sections 2.0 and 3.0 of this document. These procedures are already in use at the Military Airlift Command (MAC) and the Alaskan Command (ALCOM).

Because of the presence of non-standard communications equipment in various networks, the possibility of including equipment-unique built-in communications test features in an overall fault-isolation capability is being investigated. This investigation is examining modem, multiplexor, and crypto equipment used in certain Air Force WWMCCS communications networks and data on site-unique communications problems and solutions are being collected.

1.1.2 WWMCCS Local-Host Communications Network Fault Isolation

A WWMCCS local-host communications network is a set of remote terminals connected to a Datanet 355 (DN355) communications front-end processor in a dedicated host-system environment as opposed to a communications network designed for the internetting of separate WWMCCS host systems. The communication elements contained in a WWMCCS local-host network can be generalized as shown in Figure 1. The HONEYWELL H6000 host computer, DN355, remote terminals (Visual Information Projection - VIP, Remote Line Printer - RLP, Teletype - TTY, and System 700) and the H6000 and DN355 operating systems (General Comprehensive Operating Supervisor - GCOS, and General Remote Terminal - GRTS, respectively) are supplied by the WWMCCS ADP contract. In general, the intermediate communications subsystems are provided by specific communications contractor(s) for each network.

Normally, the operational user at a remote terminal is the first to detect a communications problem. Each WWMCCS local-host communications network has an operation dedicated to solving

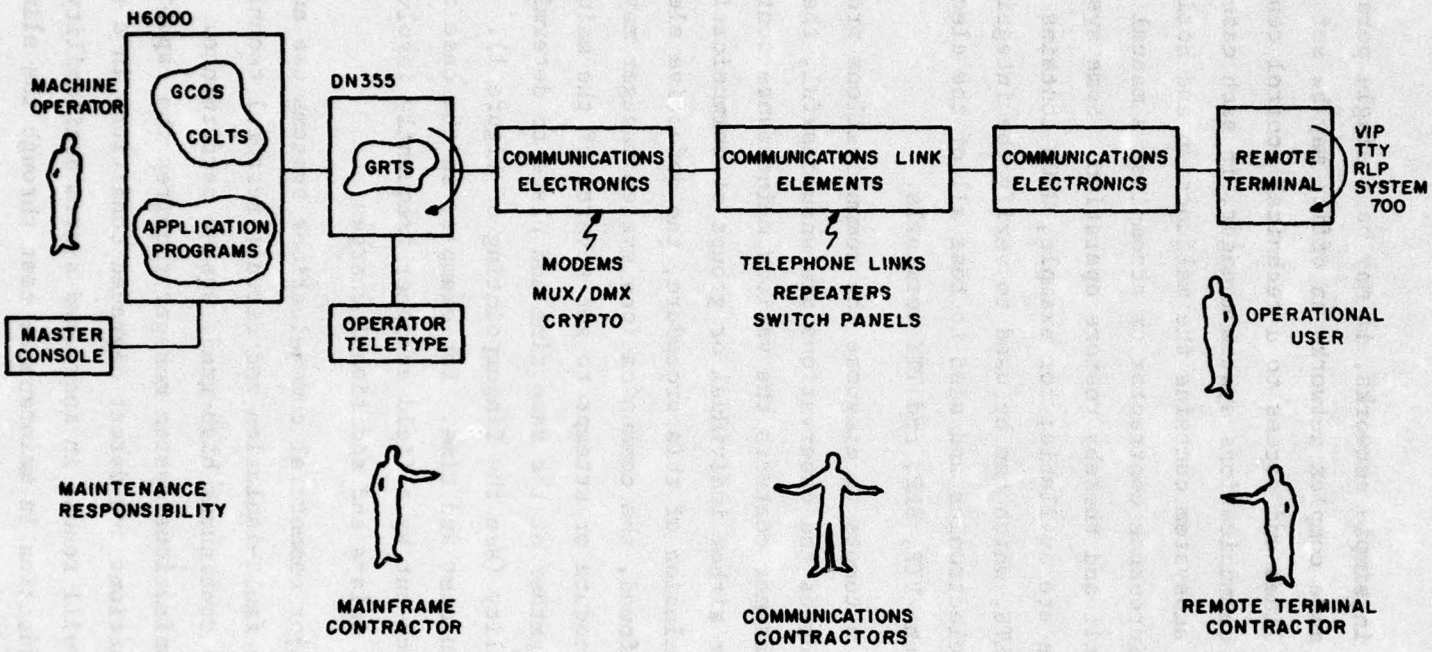

Figure 1. WWMCCS General ADP Communications Elements

such problems; in simple networks, it may be a single person at the host site; for more complex networks an office may be set up with multiple phone lines and access to a technical control center. The mission of the communications system manager, in each case, is to identify which subsystem contains the malfunction and notify the appropriate maintenance contractor or accomplish a manual switchover to a standby unit and thereby restore operation. Some system fault-isolation tools are available; for example, GCOS contains an integral capability, COLTS, which can be used to verify the integrity of the interal DN355 electronics and also to test all of the electronic subsystems in the VIP, RLP, and TTY terminals.

If attempts to diagnose the communications problem with standard procedures and observations are unsuccessful, the communications system manager contacts the various maintenance contractors responsible for either individual or groups of communication elements. If, at the conclusion of this procedure, the defective element(s) have not been found, the communications system manager may either repeat the procedure or attempt to get several of the maintenance contractors together at the same time and place to determine which has responsibility (see the fingerpointing of Figure 1). This process is expensive in cost and time. For example, in the case of remote terminals, check-out by a field engineer frequently involves transportation delays and additional charges.

Major commercial communications systems use automatic or semi-automatic fault-isolation and circuit-restoral techniques to provide nearly continuous high-grade system performance. Similarly, a WWMCCS communications system manager requires the capability to isolate malfunctions and detect degraded conditions in a rigorous manner. This will result in increased system availability for remote users and a rdduction in maintenance cost through the elimination of unnecessary maintenance requests.

1.2 Overview of System 700 Remote Terminal Diagnostics

System 700 T&D software is supplied to all installations, usually in the form of punched card decks and/or paper tape. The WWMCCS ADP contract (GS-00S-08323) System 700 Software Library includes the following:

- FORTRAN Compiler
- DAP Macro Assembler
- Basic Interpreter
- Operating System 700 (OS700)
- Batch Operating System (BOS)
- Utilities (Loaders, Source Update, Debug, etc.)
- Device Drivers
- Test and Diagnostic Routines

For each WWMCCS System 700 installation, HONEYWELL delivers the appropriate T&D programs for the configured equipment. Table I is a listing of the System 700 hardware components available on the WWMCCS ADP contract through Amendment P00063 (June 1976). Table II is a complete listing of T&D's maintained by HONEYWELL.

T&D documentation is also delivered to each installation in the form of program listings (a set of three-ring notebooks labeled Test and Verification). Use of this documentation by WWMCCS operators is difficult because it is applicable to all HONEYWELL minicomputers and peripherals and because it requires a number of parameter settings which are not clearly identified.

A typical WWMCCS System 700 Remote Batch terminal configuration is shown in Figure 2. A variety of communications elements are possible between the DN355 and the System 700. These include modems, multiplexers, crypto devices, and communication lines, all of which are normally transparent to the data-transfer operation. Although there is very little commonality among WWMCCS networks, the overall

TABLE I

WWMCCS System 700 Hardware Component List

Model No.	
700-7200	716 CPU, 4K Memory, Real Time Clock, High Speed Arithmetic, Base Sector Relocation, Direct Memory Access
725G,735G	716 CPU, Real Time Clock, High Speed Arithmetic, Base Sector Relocation, Direct Memory Access (Requires one 700-1209 or 700-1210)
700-3000	Crystal Clock and Watchdog Timer
700-3010	Data Multiplex Control Adapter
700-1201	Additional 4K Memory Module
700-1202	Parity, First 4K Memory
700-1203	Parity, Additional 4K Memory
700-1206	Additional 8K Memory Module (without Parity) for 700-7200
700-1207	Additional 8K Memory Module (with Parity) for 700-7200
700-1209	Additional 8K Memory Module (without Parity)
700-1210	Additional 8K Memory Module (with Parity) (Requires 700-1211)
700-1211	Memory Parity Control (one per 716 CPU)
700-2021	Memory Lockout
700-2022	Extended Memory System Control (32K Main Memory)
32766	Electrically Alterable Read Only Memory (ROM)
700-1220	256 Word ROM
700-1221	512 Word ROM
700-1222	1024 Word ROM
700-1223	2048 Word ROM
700-5151	Card Reader Subsystem (300 CPM, DMA)
700-5162	Card Reader Subsystem (600 CPM, DMA)
700-5163	Card Reader Subsystem (800 CPM, DMA)
700-5164	Card Reader Subsystem (1050 CPM, DMA)
700-5140	Card Reader/Punch Subsystem (400/100 CPM, DMC)

TABLE I (Continued)

Model No.	Description
700-5172	Card Reader/Punch Subsystem (400/100-400 CPM, DMA)
700-5176	Card Punch Subsystem (100-400 CPM, DMA)
700-5010	Paper Tape Reader Subsystem (300 char/sec)
700-5210	Paper Tape Punch Subsystem (110 char/sec)
700-5515	Line Printer Subsystem (200 LPM, 96 Column, DMC)
700-5565	Line Printer Subsystem (300 LPM, 132 Column, DMA)
700-5576	Line Printer Subsystem (450 LPM, 132 Column, DMA)
700-5527	Line Printer Subsystem (650 LPM, 120 Column, DMC)
700-5577	Line Printer Subsystem (650 LPM, 132 Column, DMA)
700-5568	Line Printer Subsystem (950 LPM, 132 Column, DMA)
700-5529	Line Printer Subsystem (1100 LPM, 120 Column, DMC)
700-5569	Line Printer Subsystem (1100 LPM, 132 Column, DMA)
700-5517	96 to 132 Column Upgrade for 700-5515
700-5511	120 to 132 Column Upgrade for 700-5527 and 700-5529
700-4743	Disk Controller (4 Drives Max.) and Disk Drive (7.5×10^6 Words, DMC)
700-4753	Additional Disk Drive for 700-4743 (7.5×10^6 Words)
700-4781	Disk Controller (4 Drives Max.) and Removable Disk Drive (7.5×10^6 Words, DMA)
700-4785	Additional Removable Disk Drive for 700-4781 (7.5×10^6 Words)
700-5400	Cassette Tape Subsystem
700-5401	Additional Cassette Drive for 700-5400
700-4021	Mag Tape Controller (4 Drives Max.) and Tape Drive (7 Track, 26 ips, DMC)
700-4022	Additional Tape Drive for 700-4021
700-4041	Mag Tape Controller (4 Drives Max.) and Tape Drive (7 Track, 26 ips, DMA)
700-4042	Additional Tape Drive for 700-4041
700-4051	Mag Tape Controller (4 Drives Max.) and Tape Drive (9 Track, 26 ips, DMA)

TABLE I (Continued)

Model No.	Description
700-4052	Additional Tape Drive for 700-4051
700-5307	ASR-33 Teletype Subsystem
700-5507	ASR-35 Teletype Subsystem
700-6312	Synchronous Single Line Controller
700-6313	Code Convention Option for 700-6312
700-6314	50×10^3 Bit/sec Block Transfer Option for 700-6312 (Requires 700-6313)
700-6316	MIL STD 188C Interface Option for 700-6312
700-6321	Low-Speed Multiline Controller (up to 128 data comm lines, 45 - 300 Baud Async)
700-6351	Line Module Interface for 700-6321 (four type 103 data sets)
700-6333	Medium Speed Multiline Controller (up to 16 data comm lines, 28 - 2800 Baud Async, up to 10,800 Baud Sync)
700-6362	Async Line Module Interface for 700-6333 (for two type 103, or 202 data sets)
700-6363	Sync Line Module Interface for 700-6333 (for two type 201 or 203 data sets)
700-6322	Universal Multiline Controller (up to 64 data comm lines, 45 - 2800 Baud Async, up to 10,800 Baud Sync)
700-6352	Async Line Module Interface for 700-6322 or 6324 (for two type 103 or 202 data sets)
700-6353	Sync Line Module Interface for 700-6322 or 6324 (for two type 201 or 203 data sets)
700-6323	Block Transfer Option for 700-6322
700-6324	Block Mode Universal Multiline Controller
700-6926	Asynchronous Modem Bypass (one RS232C 4W interface, $\leq$ 2500 ft, $\leq$ 10,800 Baud)
700-6925	Synchronous Modem Bypass
700-3100	716 to 716 Intercomputer Comm. Unit (DMA)
700-3030	Bi-Sync Down-Line Load Option (Requires 700-6312 and 6313)
6400	AUTODIN Interface Controller

TABLE I (Concluded)

Model No.	Description
SRPQ-128-A	Real Time Clock, Programmable, 20 Microseconds
SRPQ-128-B	Interface Message Processor/Modem Interface
SRPQ-128-E	Priority Interrupt Adapter, 16 Lines
SRPQ-128-F	Datanet 355/System 700 Coupler (50K char/sec)
SRPQ-128-G	Datanet 355/725-G Cables (50 Feet)
700-9040	Micropac Drawer (with Power Supply)

TABLE II

System 700 Test and Diagnostic Software Document List

Name	Revision	Description
AB16-TIME 1	A	Instruction Timing Demonstration
AB16-CCT4	K	Main Frame Instruction Test
AB16-CMT5	E	Memory Test
AE16-PFT3	K	Power Failure Test
AB16-05T3	D	Extended Addressing Test
AE16-07T6	J	Parity Test
AE16-08T4	M	Memory Lockout/Base Sector Relocation
AB16-11T1	D	Multiply/Divide Test
AB16-12T3	G	Core Real Time Clock
AA16-ROMT1	C	Read Only Memory Test
AA16-3000T1	C	External Real Time Clock/WDT Test
AA16-2022T1	A	64K Memory Test
AA16-2022T2	B	64K CPU Test
AA16-9070T1	B	DMA Buffer Board Test
AE-MTT2	L	7 Track Tape Test
AB16-4020T4	B	7 Track Tape Byte Mode Test
AE16-MTT3	F	9 Track Tape Test
AA16-5400T1	C	Cassette Test
AB16-4180T1	F	1600 BPI Mag Tape Test
AA16-4051T1	D	VLC - 7/9 Mag Tape Test
AB16-47T3	G	2-20 Surface Moving Head Disc Test (8K)
AA16-4760T1	A	Cartridge Disc Test
AA16-4780T1	A	SP-10 Moving Head Disc Test
AG16-RPT2	F	Paper Tape Reader/Punch Test
AA16-51XXT5	B	SP-10 Card Equipment Test
AB16-51XXT6	D	Card Reader/Punch Test

TABLE II (Concluded)

Name	Revision	Description
AB16-RPT4	B	Card R/P Punch-Feed-Read Test
AG16-TWT1	D	Teletype Test
AB16-55T3	G	HONEYWELL Line Printer Test
AA16-55XXT4	B	SP-10 Line/Serial Printers
AA16-6312T1	D	Synchronous Single Line Controller Test (8K)
AA16-6312T3	A	Synchronous Single Line Controller Test (4K)
AA16-6314T1	C	Synchronous Single Line Controller with DMA Test (8K)
AA16-6315T1	A	HDLC SSLC Test
AA16-6321T2	C	Low Speed Multiline Controller Static Test
AA16-6322T2	A	Universal Multiline Controller Static Test
AA16-6322T1	D	MLC Functional Test
AA16-6902T1	A	Auto-Call Functional Test
AA16-MLB9	B	MLB (6333) Test
AA16-CRC9	A	CRC Generator (2050) Test
AA16-ADB9	A	MLB Auto-Call Test
AA16-XFEP	E	716 to H200 Coupler Transfer Test
AA16-LFEP	B	716 to H200 Coupler Loop Test
AA16-RFEP	F	716 to H200 Coupler Reflect Test
AA16-3100T9	B	H716 to 716 ICCU
AA16-RTAIT1	B	716 Analog Inputs Test
AA16-RTDCT1	B	DDC PAC Test
AB16-RTD1T2	B	Digital Interface Test
AA16-4510T1	C	Fixed Head Disc Test

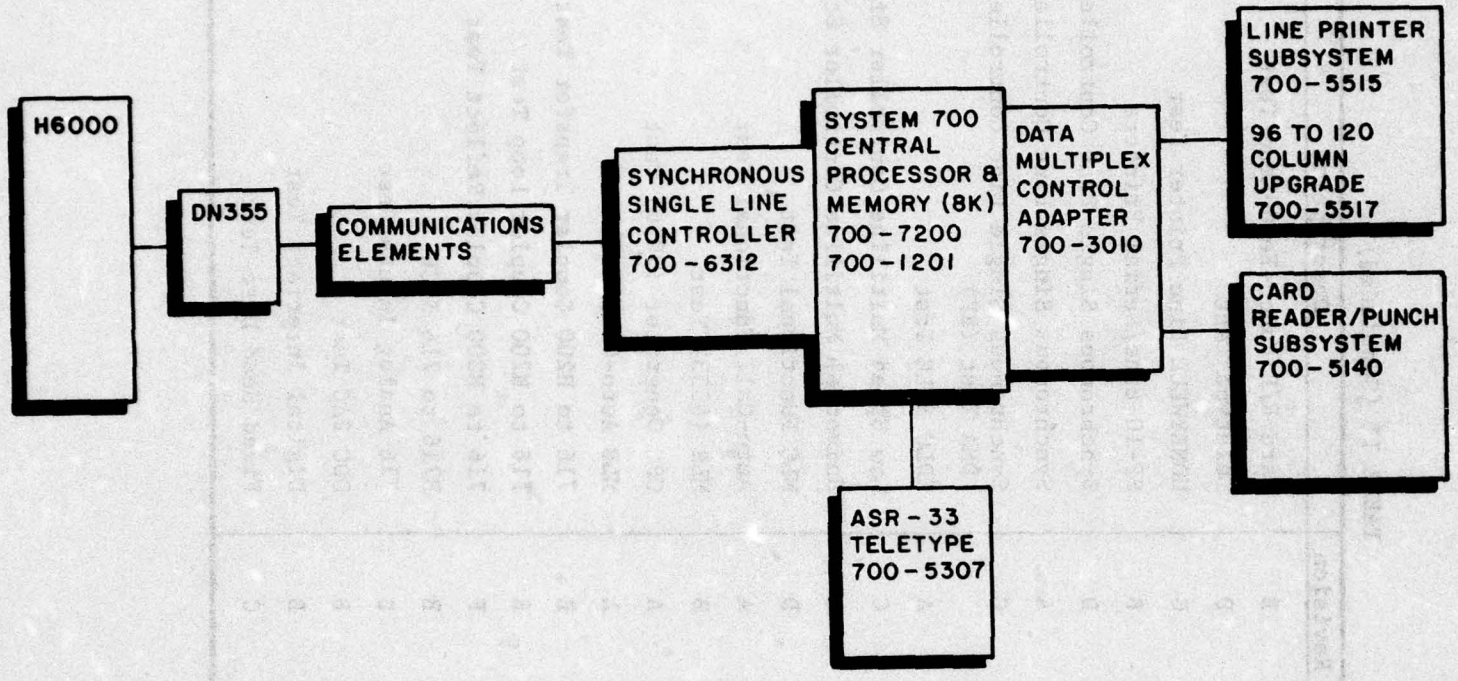

Figure 2. Typical System 700 Remote Batch Terminal Configuration

fault-isolation problem is the same and a common technique which is rigorous and thorough can be employed. The ability to verify the operational status of the System 700 is one of the requirements of this technique.

With a minimum of training, which can be accomplished on-site, it is possible for WWMCCS operators to learn how to use the T&D programs. The T&D programs provide an extremely important capability for any System 700 installation regardless of the type of field engineering maintenance available. Exercise of the System 700 using the programs allows verification of the operational status of System 700 hardware in a rigorous and complete manner in a matter of minutes. In most cases, the need for field engineering maintenance can be identified immediately and the data generated in the test process provides important information for the maintenance engineer.

1.3 Conclusions

HONEYWELL has provided the Government with a set of off-line diagnostic software capable of testing all of the major electronic subsystems and components of a System 700 Remote Batch Terminal in a rigorous and thorough manner. In order to utilize this software in routine daily operations, detailed step-by-step procedures, based on the procedures in this report, are required for System 700 operators. Regular utilization of the diagnostic software and procedures will result in increased System 700 availability, less downtime, a higher probability of critical mission success, and identification of probable sources of communications failures at the System 700 interface.

1.4 Recommendations

1.4.1 Training

- The ADP manager of each System 700 installation should ensure that all senior operators are capable of exercising the T&D software. This can be accomplished through on-the-job training.

- The WWMCCS Single Service Training Manager (AFC) should introduce a System 700 operator training course in the execution of the T&D software.

1.4.2 Preventive Maintenance

- The ADP manager of each System 700 installation should establish a preventive maintenance schedule which includes regular exercise of all applicable T&D's for that configuration. Frequency of application is dependent on system usage and should be worked out with the cognizant HONEYWELL Field Engineering Office. For example, for a system used twenty-four hours per day, seven days per week, one preventive-maintenance exercise per week normally should be scheduled.

1.4.3 Diagnostic Maintenance

- When difficulties are experienced in the routine operation of the System 700 installation, the ADP manager should direct that either all or specific T&D's be exercised to provide a benchmark of the system capability. The results of this test will clearly establish the operational capability of the System 700 to communicate with the host H6000, i.e., the fault will be established either at the System 700 end of the communications link interface or on the host side. Furthermore, some indication of the source of the problem in the System 700 will be established.

- In normal system operation, the System 700 operator will coordinate the exercise of any off-line T&D software execution with the host H6000 system manager. It is then the System 700 operator's responsibility to load the diagnostic programs (either by card deck or paper tape through the ASR-33 Teletype), initiate execution according to the operator procedures, detect error printouts, and accurately communicate this information to the HONEYWELL Field Engineering Office.

1.4.4 Critical Operational Missions

- Before a System 700 is dedicated to a critical operational mission, the ADP manager should direct that the system performance status be verified by exercising the complete set of T&D's. This rigorous and complete test will verify whether or not the System 700 is in optimum condition to perform the mission.

1.4.5 Datanet 355/System 700 Communication Link Fault Isolation

- The System 700 operator, in coordination with the host H6000 ADP system manager, should use the System 700 Synchronous Single Line Controller Test and Diagnostic capability to isolate faults on the communications link between the DN355 and the System 700. This operation, which involves establishment of "loopback" conditions on the link, provides the capability to isolate a fault in a number of different subsystems in a rigorous and complete manner. The System 700 ADP manager should write a tailored step-by-step procedure for this operation based on the procedures furnished herein. This procedure should describe the particular subsystems, switch settings, and conditions unique to that network.

2.0 SYSTEM 700 TEST AND DIAGNOSTIC SOFTWARE DESCRIPTION

2.1 Application Guidelines

In utilizing System 700 Test and Diagnostic procedures, the following general guidelines and assumptions are applicable:

a. The software in most cases allows a wide degree of test definition; for example, the test message composition can be varied, the order of test execution is programmable, etc. For clarity and preciseness, WWMCCS operator procedures described in this report were designed in a step-by step format with fixed message compositions and definite predetermined results.

b. Certain of the delivered System 700 diagnostic programs are most useful during system installation and are not applicable to general WWMCCS use. However, it is expected that, as the WWMCCS program matures, a number of other programs will provide additional benefits for operational configurations.

c. Because of variations between different System 700 configurations, there will be slight variarions in output from installation to installation due to memory size, peripheral options, or, in some cases, instruction execution speed. Site configuration variations should be incorporated in the operator procedures prepared by each site manager. Assistance with such problems can be obtained from ESD/WW.

d. For comparison purposes, each site should maintain a standard set of output for all of the hard-copy tests (line printer and teletype). This should be obtained when the equipment is operating according to specification.

e. A modification for operator convenience should be made to the diagnostic card decks as delivered by HONEYWELL for all programs except the console ASR-33 Teletype program (AG16-TWT1). The modification -- the insertion of a tranfer card (punched: Col. 1 Row 4; Col. 4 Row 0) before the final blank card in each deck -- causes the test to start automatically after the card deck is loaded. This change speeds the checkout process; the procedures included herein assume this change has been made except for AG16-TWTL.

2.2 Processor Subsystems

To test the Central Processor, the following programs were selected and incorporated into a single procedure: AB16-CCT4 Instruction Logic, AB16-Time 1 Instruction Execution Time, and AB16-11T1 Arithmetic Option. Note that, for simplicity, the memory program described in Section 2.3 is also included in this procedure.

2.2.1 AB16-CCT4 Main Frame Instruction Test

This program consists of 35 tests which exercise the processor. The tests have the following names: Generic Instructions: Location '0' and X Reg Traction; Addition; Sense Switch; Adder Test 1, 2, and 3; Add-Subtract; Indirect Addressing; IMA, IAB, IRS, ERA, ANA, CAS Instructions; Half-word Instructions; STX, LDX Instructions; INK, OTK Instructions; ARS, ALS, LGL, LGR, ALR, LRS, LLS, LLL, LRL, LLR Instructions; General Shifts; ENB, INH Instructions; S. P. Multiplication Capability; S.P. Divide Capability; 716 Instructions Test Parts I and II. Execution time is about 100 seconds. The program stops whenever it finds an error.

2.2.2 AB16-Time 1 Instruction Timing Demonstration

This program determines the execution times for various instructions. The instructions timed are: NOP; LDA; LDA Indirect; STA; SZE A=0; CAS Equal Condition; CAS Less Than Condition; ALR 1 Shift; ALR 2 Shifts; SKS ASR-Not Interrupting; MPY; DIV. Execution time is about 30 seconds. If an error is determined, there will be an error printout after which the program may or may not continue depending upon the particular instruction.

2.2.3 AB16-11T1 Multiply/Divide Test

This program traces the path of a subroutine using JST instructions. The arithmetic option instructions are traced in the following order: MPY, DIV, SCA, NRM, DLD, DST, DAT, DSB, the MPY and DIV instructions using a table of 112 most-significant entries and 112 least-significant entries. The program executes 5000 passes in about 55 seconds after which there is a printout. If an error is detected, the program will halt.

2.3 Memory Subsystems

2.3.1 AB16-CMT5 Memory Test

This program tests all of the core memory subsystems with five test-pattern routines. Address Test - checks each location for uniqueness; Worst Case Pattern Test - a double checkerboard pattern; Complemented Worst Case Pattern Test - ones complement of the previous test; Pseudo Random Number Pattern Test - a pseudo-random number string; Bit Pattern Test - memory cleared to all zeroes, then each memory cell changed to all ones, read, complemented, stored and reread. The program executes in about eight seconds; it requires two passes. For the second pass,the program is relocated to a section that has been tested and the prior program locations are tested. Error messages are printed out, and the program continues.

2.4 Console Teletype Subsystems

2.4.1 AG16-TWT1 Teletype Test

This software tests the Console ASR-33 Teletype. Certain operations in the exercise of this program require operator action within a specified time, otherwise the program will abort; therefore, the operators must familiarize themselves with the entire procedure before starting. Copies of the test printout should be dated and maintained in a file for reference to detect gradual degradation of print quality.

The program has seven test routines which test all features of the teletype with appropriate operator interaction and/or observation as follows:

a. Function Test Routine - tests the interface option to insure the instruction subset is operational and checks all normal mode instructions and functions.

b. Page Printer - prints 70 lines (or less as an operator option) of a rotating test pattern which includes the entire print font, after which a full line is printed for every character printed in the first line of the rotating pattern.

c. Keyboard Input - echoes back characters entered from the keyboard in both an immediate mode and a delayed one character mode (the character output lags the character input by one to demonstrate full duplex operation).

d. Answer Back Drum Test - outputs a WRU code to the teletype and tests for an Error Halt for 20 interrupts.

e. Null Character Test - operator verifies that an output data string containing all null characters does not print out.

f. Punch and Reader Test - punches a tape after which it is read-in and checked.

g. Punch and Reader Full Duplex Test - operates the reader and punch in a full duplex interrupt-driven fashion (the data is 12 blocks of an X and Z pattern).

Depending on the amount of printout desired, this program can take more than five minutes to run.

2.5 Line Printer Subsystems

2.5.1 AB16-55T3 HONEYWELL Line Printer Test

This program requires that a test control tape be mounted in the line printer. Instructions are detailed later for preparation of this tape.

The diagnostic software tests the following printer functions: I/O Bus Non-Interrupt, Blank Printing, Status Reporting, Paper Advance, Open Type Roll Housing Interlock, Print-Line Alignment, and Pattern Printing. The complete test requires about ten minutes. Error messages are printed out without terminating the test.

2.6 Card Reader/Punch Subsystems

The random card deck used for test purposes in executing these diagnostics is designed to be generally applicable to all installations. Each System 700 installation is responsible for building such a test deck for its own use. The first part of this test deck consists of a copy of the diagnostic software itself. Having this program as part of the test deck is useful when the Card Reader/Punch

diagnostic must be loaded from paper tape in order to begin execution. This step will verify or eliminate the possibility of incorrect loading of the diagnostic program as the source of an initiation problem. Similarly, using the actual operating system program as part of the random card deck tests the system ability to load its operating system correctly. The error-detection test assumes that the random card deck is built according to this format.

Two copies of each test deck should be maintained at each installation.

2.6.1 AB16-55XXT6 Card Reader/Punch Test

This diagnostic software checks out all the functions of the card reader/punch. To test card motion, the operator cycles a deck of 200 blank cards and checks for a completion time of 30 seconds $\pm$ 3 seconds. A special Hollerith test deck is used to test the card reader's ability to read Hollerith cards. To test the card reader's ability to read binary decks and detect errors, a binary test deck is entered and then re-read with the first card changed to a blank card. The card motion in the punch is tested by cycling a deck of 200 blank cards through a punch operation (without punching) and verifying a completion time of 120 seconds $\pm$ 12 seconds. Its ability to punch a random deck is tested by first punching a test deck and then re-reading it for verification. If all the subtests are exercised (assuming a read binary test deck of 500 cards and a punch binary deck of 50 cards), the test time will be six to ten minutes. Errors are printed out on the operator's teletype.

2.7 Communications Control Subsystems

2.7.1 AB16-6312T3 Synchronous Single Line Controller Test

This program requires 4K of main memory and is similar to AB16-6312T1. The software tests the subsystem data communications

transfer capability both internally and externally. Errors are printed on the operator's console without terminating the test. Internally, the configuration and status logic are verified and the synchronization and data-transfer capability in all modes are tested up to the communications interface. Externally, the program has a powerful fault-isolation capability which can be used on the communications link connecting the System 700 to the host computer. The software allows the machine operator to initiate a special test mode called "DEBUG" which effectively transforms the System 700 into a data communications test set. Each communications link will have a specific set of "loopback" points, e.g., a modem switch which connects the transmit and receive lines together. Once the loopback switch is set, the operator can cause a message to be transmitted over the link and verified in about three seconds. A unique procedure written by the System 700 ADP manager for each installation with detailed instructions for step-by-step execution of successive loopback verifications should be used.

This program provides the WWMCCS community with a rigorous test capability that overlaps the maintenance responsibilities of both HONEYWELL and the communications contractor(s). This is significant because HONEYWELL field engineers normally will not execute tests on communications equipment provided by another contractor -- and vice versa.

3.0 SYSTEM 700 TEST AND DIAGNOSTIC OPERATOR PROCEDURES

3.1 General Utilization Guidance

The SYSTEM 700 Test and Diagnostic programs can be executed only when the SYSTEM 700 is "off-line" to the host H6000 system. Accordingly, coordination must be obtained with the host system before any SYSTEM 700 diagnostics are executed. In general, after any test operation is complete, the SYSTEM 700 operating systems must be reloaded to restore normal operation.

The use of test and diagnostic procedures on the part of the WWMCCS operator is to establish a requirement for field engineering support and to identify the appropriate contractor. It is not intended that WWMCCS operators diagnose or correct equipment failures; moreover, since the Test and Diagnostic software provides a very rigorous system exercise, indiscriminate use of these programs can cause early wear-out of electro-mechanical components. WWMCCS operators are cautioned to use the Test and Diagnostic software only as directed.

The WWMCCS operator's responsibility with regard to the SYSTEM 700 Test and Diagnostic software is direct and simple:

a) The operator should be capable of loading the Test and Diagnostic software using standard program-loading procedures. The operator should be familiar with the SYSTEM 700 operator's panel and should recognize that an expression such as "key in Y = '0010000" means to place the STOP/RUN switch to STOP, select UPPER and Y on the REGISTER SELECT switches, and to depress switch 7 and the master entry switches.

b) The operator should look for deviations between the observed system outputs and the outputs predicted in the test procedure. Such deviaitons could take the form of an error printout on the operator's console such as:

ERR @ 2217 H IS 000020 SB 000000

or could be a deterioration in the quality of the hardcopy test output. In either case, the operator does not have to understand what the error indications shows; he must simply recognize the error.

3.2 Main Frame Procedures

3.2.1 700-7200 Processor/700-1210 Memory (Preliminary)

STEP 1 - Load the AB16-CCT4 card deck using the normal program loading procedure with the Boot Loader. The following teletype message should occur:

AB16 CCT4 APR 24, 73 REV H
SENS SW TO A REG 8 TIMES

STEP 2 - Depress A on REGISTER SELECT. Depress REGISTER CLEAR. Depress SENSE SWITCH 4. Depress START. Only Bit 4 of the DISPLAY REGISTER should be illuminated.
Depress SENSE SWITCH 3. Depress START. Only Bits 3 and 4 should be illuminated.
Depress SENSE SWITCH 2. Depress START. Only Bits 2,3 and 4 should be illuminated.
Depress SENSE SWITCH 1. Depress START. Only Bits 1, 2, 3 and 4 should be illuminated. Reset SENSE SWITCH 4. Depress START. Only Bits 1, 2, and 3 should be illuminated. Reset SENSE SWITCH 3. Depress START. Only Bits 1 and 2 should be illuminated. Reset SENSE SWITCH 2, Depress START. Only Bit 1 should be illuminated. Reset SENSE SWITCH 1. Depress START. No bits should be illuminated and the following teletype message should occur:

DONE
CP is 716 MMSZ 8K

The program automatically starts a diagnostic test which is executed in about 100 seconds. If the program detects an error, it stops. This must be detected by the operator by either a time out or observance of non-flickering of the DISPLAY REGISTER indicators and a dark RUN indicator. At a successful completion of the test this teletype message occurs:

PS 0001

Put STOP/RUN in STOP. Depress Y on REGISTER SELECT.

STEP 3 - Load the AB16-TIME 1 card deck using the normal program loading procedure with the Boot Loader. The following teletype message should occur:

AB16 - TIME 1 DOC NO 70185768000 REV A
INSTRUCTION TIMING DEMONSTRATION PROGRAM
TYPE R (RTC) or T (60 SEC) and CR.

STEP 4 - Enter an R and a RETURN on the teletype. The teletype will output

WHAT IS THE REAL TIME CLOCK FREQ IN HZ

STEP 5 - Enter the number 60 and a RETURN on the teletype. The program will execute and output a teletype message similar to the following:

INSTRUCTION	CONDITION	TIME	
NOP	NO SKIP	800 ± 40	Note: The times here will not be printed in this format but the times that are printed should fit within these ranges.
LDA		1600 ± 80	
LDA	INDIRECT	2400 ± 120	
STA		1600 ± 80	
SZE	A = 0	1100 ± 55	
CAS	=	1900 ± 85	
CAS	<	2200 ± 110	
ALR	1 SHIFT	1100 ± 55	
ALR	2 SHIFTS	1400 ± 70	
SKS	ASR-INT	2700 ± 135	
MPY		4050 ± 203	
DIV		6700 ± 335	

END OF PROGRAM
ST

STEP 6 - Load the AB16-11T1 card deck using the normal program loading procedure with the Boot Loader. The following teletype message should occur:

AB16-11T1 REV E JAN 5, 72

The program automatically starts a diagnostic test which is executed in about 55 seconds. The program will halt if an error is detected. Operator actions are the same as STEP 2 in this case. At a successful completion of the test (no errors) the following teletype message occurs:

END OF PASS 0000050000

Put STOP/RUN in STOP.

STEP 7 - Load the AB16-CMT5 card deck using the normal program loading procedures with the Boot Loader. The following teletype message should occur:

AB16-CMT5 JUN 7, 73 REV E
CP is 716

The program automatically starts a diagnostic test. If no errors are detected, a teletype output similar to the following occurs about every 8 seconds:

PS 0001	001673	017777
PS 0002	000021	016117

If the above teletype messages occur and there are no error messages, put STOP/RUN in STOP. The processor test is completed.

3.3 Console Teletype Procedures

3.3.1 700-5307 ASR-33 Teletype Subsystem

STEP 1 - Load the AG16-TWT1 card deck using the normal program loading procedure with the Boot Loader. All switches level on the CPU. Depress MASTER CLEAR. Select A on REGISTER SELECT. Depress BIT 7 causing '001000 to be set into the A Register. Select Y on REGISTER SELECT. Key in Y = '0010000. Depress STOP/RUN to RUN. Depress START. The following teletype message should occur:

AG16-TWT1 3 NOV 71 REV. B
TYPE XOFF

STEP 2 - While holding down the CTRL key, depress the XOFF/S key on the teletype. This must be done within 15 sec. The following teletype message should occur:

FULL DUPLEX FUNCTION TEST AA
TYPE XOFF

While holding down the CTRL key, depress the XOFF/S key on the teletype. The following teletype message should occur:

A

TYPE XOFF

While holding down the CTRL key, depress the XOFF/S key on the teletype. The following teletype message should occur:

A

TYPE XOFF

While holding down the CTRL key, depress the XOFF/S key on the teletype. The following teletype message should occur:

A

TYPE XOFF

While holding down the CTRL key, depress the XOFF/S key on the teletype. The following teletype message should occur:

A

PAGE PRINTER TEST

STEP 3 - Place the STOP/RUN switch on the CPU in the STOP position. Depress A on REGISTER SELECT. Depress REGISTER CLEAR. Depress BIT 13 causing '000010 to be set into the A Register. Depress Y on REGISTER SELECT. Depress STOP/RUN to RUN. Depress START. A teletype message similar to that in Figure 3 should occur. It consists of a rotating printout of eight lines of all printable symbols followed by a full line for each symbol appearing in the first line of printout (including blanks). This printout takes about nine minutes. In the first eight lines, the correct printout can be observed by scanning semi-

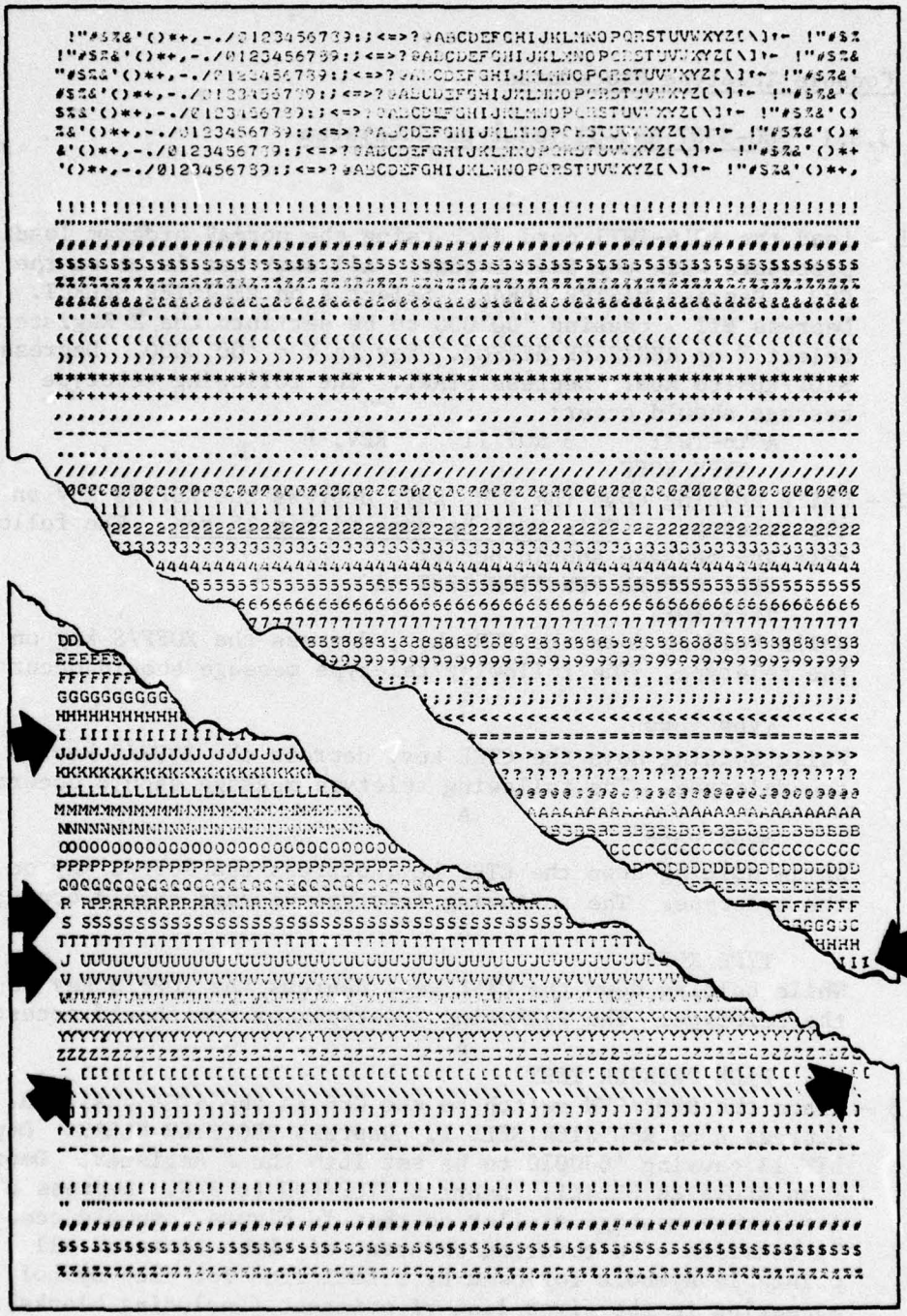

Figure 3. Page Printer Output, with Errors

vertically along a line of similar characters. During the printout of a line for each symbol, observe that the carriage return mechanism operates correctly and starts each line in the same place with no skipped characters. Note that certain lines of the sample printout contain this error condition. This malfunction tends to become worse and worse until messages are difficult to read. The print quality should also be observed for possible need to change the ribbon, clean the mechanism, etc. After the page printer output, the following message should occur:

KEYBOARD INPUT

STEP 4 - Enter the following characters on the teletype:
1234567890:-QWERTYUIOPASDFGHJKL:ZXCVBNM,./!"#$%&'()*= ← @
[\+↑]<>?
CHARACTER COUNT = 63
FULL DUPLEX KEYBOARD TEST

STEP 5 - Enter a W on the teletype. No character should be printed. Enter an M on the teletype; a W should be printed. Enter an X on the teletype; an M should be printed. Depress RETURN on the teletype; an X should be printed followed by the message:

TEST FOR ANSWER BACK DRUM

The teletype chatters during this test. The program will halt if an error is detected. The operator must observe this by either a time-out or observance of non-flickering DISPLAY REGISTER indicators and a dark RUN indicator. If no errors are detected, the following teletype message should occur in about six seconds:

NULL CHARACTER TEST - NO CHARACTER SHOULD PRINT

A row of null characters should be output to the teletype (the operator should observe that no characters are printed) followed by the teletype message:

DONE
PUNCH/READER TEST
TURN ON ASR33 PUNCH - THEN PRESS START

STEP 6 - Load a blank paper tape in the paper tape punch following the procedures in the equipment operator's guide. Depress ON on the paper tape punch. Depress START on the CPU. A teletype message should be printed out while the paper tape is being punched consisting of all the symbols in various combinations.

STEP 7 - Depress OFF on the paper tape punch. Carefully tear off the paper tape which was punched and load it into the paper tape reader following procedures in the equipment operator's guide. Depress START on the CPU and START on the paper tape reader. The paper tape should be read: a halt of the paper tape input signifies an error. If the tape was punched and read correctly, the following teletype message should occur:

```
DONE
FULL DPLX RDR PUNCH TEST
TURN ON ASR33 PUNCH - THEN PRESS START
```

It is not necessary to exercise this feature since simultaneous paper tape punch and read operations are not required operationally. The test is complete.

3.4 Line Printer Procedures

3.4.1 700-5515 Line Printer Subsystem/700-5517 96-132 Column Upgrade

STEP 1 - Remove the operational Vertical Format Tape from the Line Printer and load the test control Vertical Format Tape for AB16-55T3. (Paragraph 3.4.1.1 contains directions for preparing and loading this tape.) The TYPEROLL ON and START switches on the Line Printer should be illuminated.

STEP 2 - Load the AB16-55T3 card deck using the normal program loading procedure with the Boot Loader. The following teletype message should occur:

```
AB16-55T3 REV G NOV 72
LPM?:
```

Enter the number 200 and RETURN on the teletype. The following teletype message should occur:

```
COL?:
```

Depress RETURN on the teletype. The following teletype message should occur:

```
BUS?:
```

Depress RETURN on the teletype. The following teletype message should occur:

```
CHN?:
```

Depress RETURN on the teletype. The following teletype message should occur:

```
PI?:
```

Depress RETURN on the teletype. The following teletype message should occur:

```
DEV ADR?:
```

Depress RETURN on the teletype. The following teletype message should occur:

```
MSK BIT?:
```

Depress RETURN on the teletype. (If the line printer is not in a ready status, an error message will occur on the teletype and the test must be restarted. It is not necessary to reload the card deck to restart the test; initialize the line printer and place the STOP/RUN switch on the CPU in STOP. With all switches level on the CPU, depress MASTER CLEAR. Key in Y = '001000. Depress STOP/RUN to RUN. Depress START. The header format at the beginning of STEP 2 should occur on the teletype.) The Line Printer test should begin to execute; if there are no errors, two lines of data should be output on the Printer. (See Figure 4.) The first line should

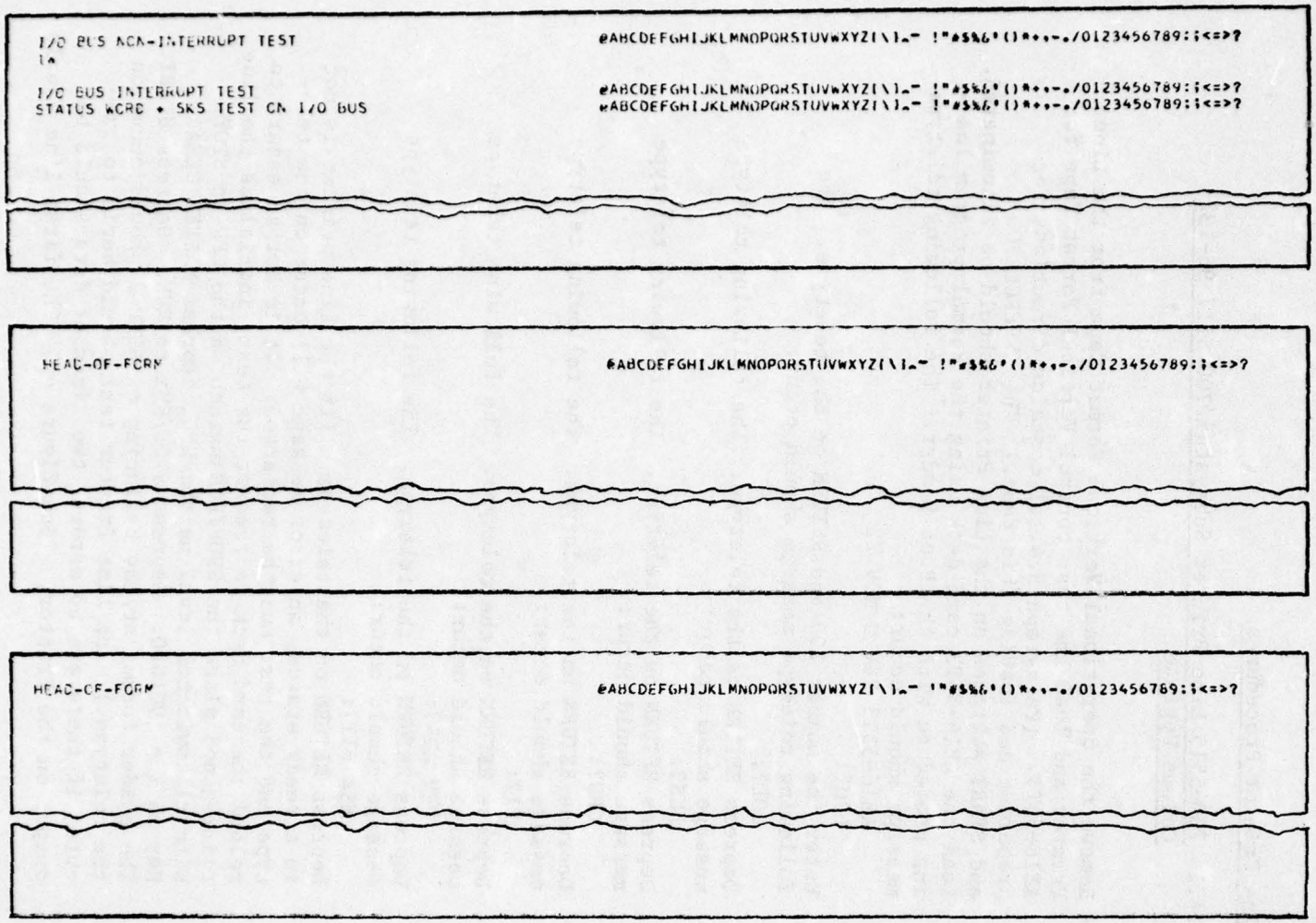

Figure 4. Line Printer Test Page Output

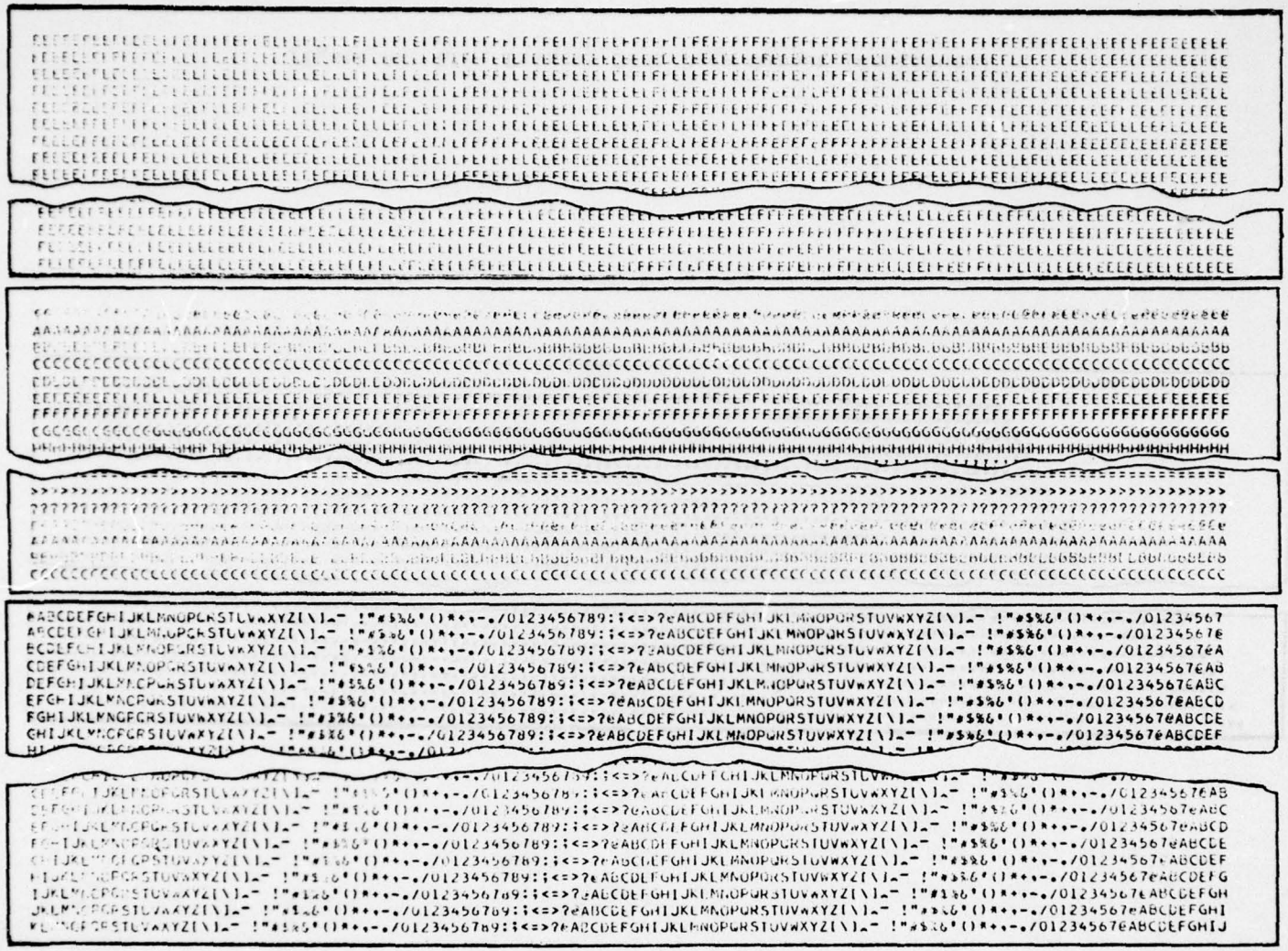

Figure 4. Line Printer Test Page Output (Continued)

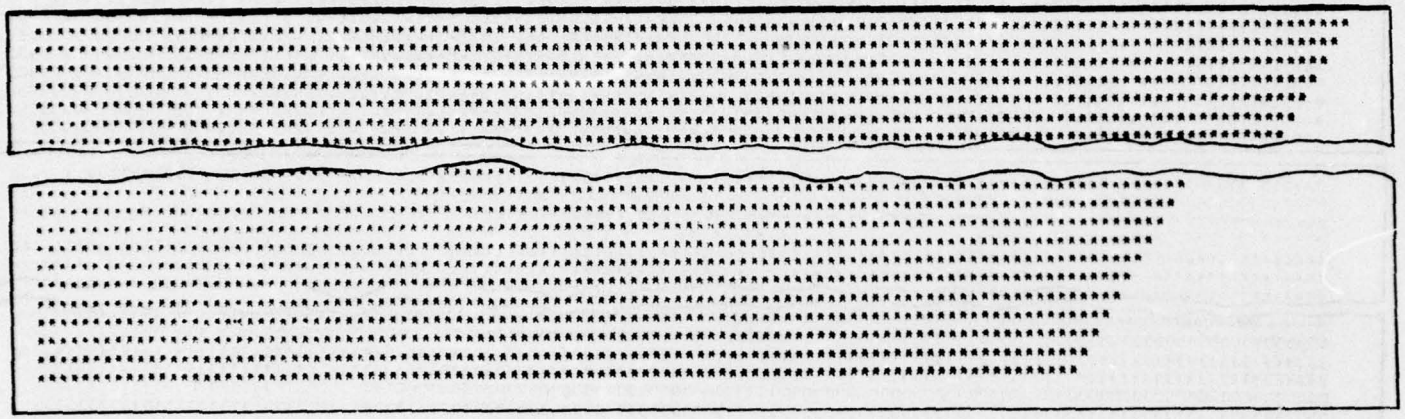

Figure 4. Line Printer Test Page Output (Continued)

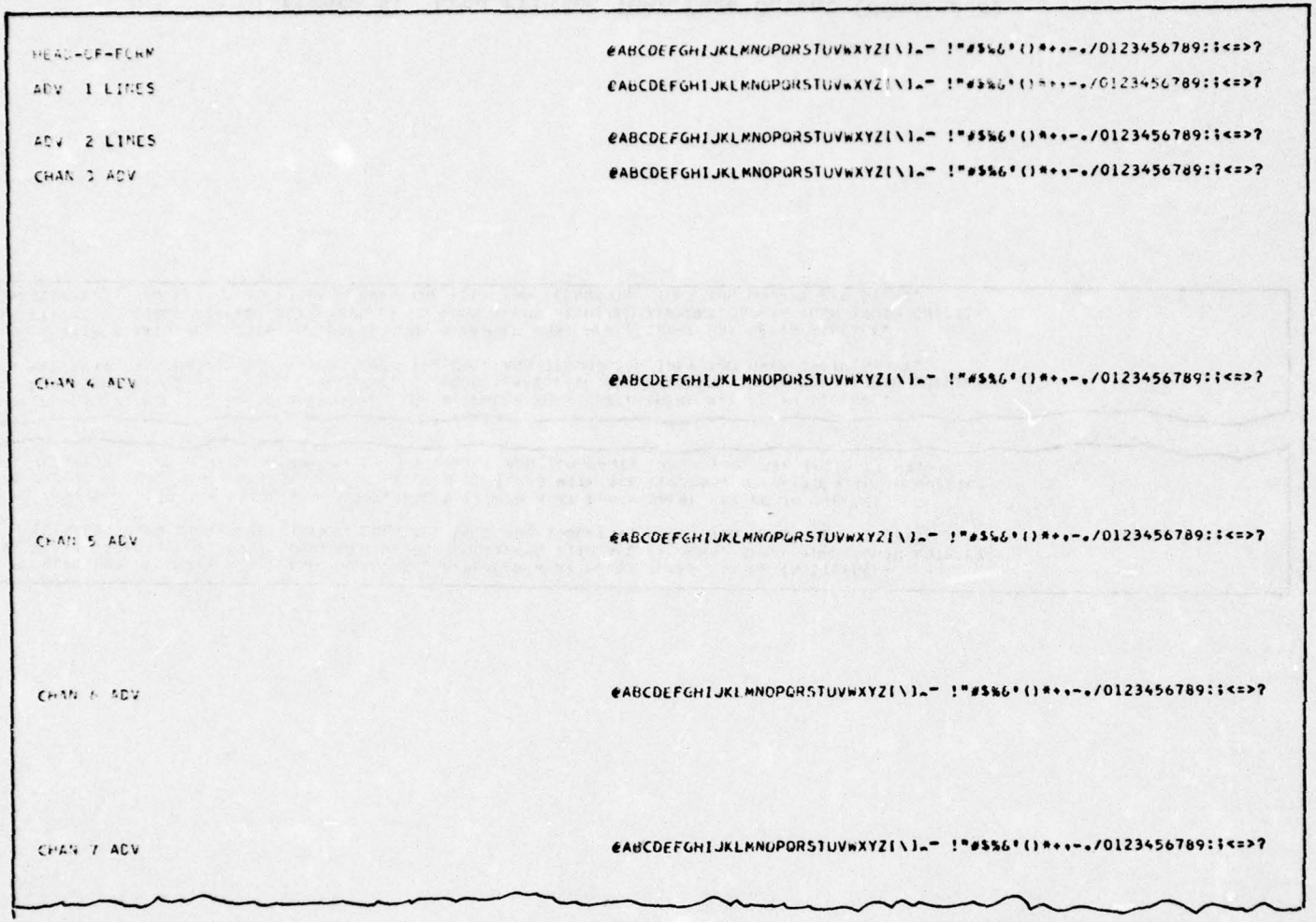

Figure 4. Line Printer Test Page Output (Continued

```
GO PLACIDLY AMID THE NOISE AND HASTE, AND REMEMBER WHAT PEACE THERE MAY BE IN SILENCE.
AS FAR AS POSSIBLE WITHOUT SURRENDER BE ON GOOD TERMS WITH ALL PERSONS. SPEAK YOUR TRUTH QUIETLY
 + CLEARLY;  AND LISTEN TO OTHERS, EVEN THE DULL AND IGNORANT;  THEY TOO HAVE THEIR STORY.

GO PLACIDLY AMID THE NOISE AND HASTE, AND REMEMBER WHAT PEACE THERE MAY BE IN SILENCE.
AS FAR AS POSSIBLE WITHOUT SURRENDER BE ON GOOD TERMS WITH ALL PERSONS. SPEAK YOUR TRUTH QUIETLY
 + CLEARLY;  AND LISTEN TO OTHERS, EVEN THE DULL AND IGNORANT;  THEY TOO HAVE THEIR STORY.
```

```
GO PLACIDLY AMID THE NOISE AND HASTE, AND REMEMBER WHAT PEACE THERE MAY BE IN SILENCE.
AS FAR AS POSSIBLE WITHOUT SURRENDER BE ON GOOD TERMS WITH ALL PERSONS. SPEAK YOUR TRUTH QUIETLY
 + CLEARLY;  AND LISTEN TO OTHERS, EVEN THE DULL AND IGNORANT;  THEY TOO HAVE THEIR STORY.

GO PLACIDLY AMID THE NOISE AND HASTE, AND REMEMBER WHAT PEACE THERE MAY BE IN SILENCE.
AS FAR AS POSSIBLE WITHOUT SURRENDER BE ON GOOD TERMS WITH ALL PERSONS. SPEAK YOUR TRUTH QUIETLY
 + CLEARLY;  AND LISTEN TO OTHERS, EVEN THE DULL AND IGNORANT;  THEY TOO HAVE THEIR STORY.
```

Figure 4. Line Printer Test Page Output (Concluded)

consist of the message I/O BUS NON-INTERRUPT TEST followed by a space and the print font: @ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^- !" #$%&'()*+,-./0123456789:;<=>@ABCDEFGHIJK. The second line should consist of the symbols 1W. The following teletype message should occur:

OCP '203 W/O '103 - LINE SHOULD BE BLANK

The Line Printer should then output two more lines of data on the first page below that printed above. The first line should consist of the message I/O BUS INTERRUPT TEST followed by a space and the print font. The second line consists of the message STATUS WORD + SKS TEST ON I/O BUS followed by the print font. The Printer should then advance and print at the top of the next page the message HEAD-OF-FORM followed by the print font. The printer should then advance again and repeat this output. This operation occurs very quickly. The three pages of printout should be examined after the test is completed. The following teletype message should occur:

HIT STOP, FORMS AND START

STEP 3 - On the Line Printer depress the STOP switch, the FORM/SPACE switch, and the START switch in that order. The following teletype message should be repeatedly output:

OPEN TYPE ROLL HOUSING

STEP 4 - Raise the cabinet assembly on the Line Printer to allow access to the internal printer controls. Release the latch on the front door assembly and open the door. The Fault indicator should be illuminated. The teletype output should then change to the following repeated message:

CLOSE TYPE ROLL HOUSING

If the teletype continues to output OPEN TYPE ROLL HOUSING, this operational check is in error.

STEP 5 - Close and relatch the front door assembly. The Fault indicator should extinguish in about 5 seconds. After this, depress the START switch on the Line Printer. The following teletype message should occur:

NEXT?:

If the teletype message continues to repeat CLOSE TYPE ROLL HOUSING rather than NEXT?, this operational check is in error.

STEP 6 - Enter the message MIX followed by depressing RETURN on the teletype. The Line Printer should then output the following:

128 lines, each composed of all E's

132 lines of characters consisting of a pattern containing a complete line of symbols for each symbol in the font @ABC...? (including the space) in that order repeated twice followed by a line of @'s, a line of A's, a line of B's, and a line of C's.

132 lines of characters in which common symbols appear from line to line along a diagonal caused by stepping the character print positions one place to the left as each line is advanced.

266 lines of asterisks in a pattern consisting of lines of decreasing length, repeated completely twice and then partially.

Two passes through the channel advance control which results in two identical printouts containing the line advance and channel advance printouts followed by the complete print font on each line.

Twenty-two outputs of a three-line canned text.

The following teletype message should occur:
NEXT?:

STEP 7 - Remove the test control Vertical Format Tape and install the operational Vertical Format Tape. Restore the Line Printer to a "ready" condition. A full-size standard printout should be maintained with these test procedures for comparison with the test results. Compare the test output of the Line Printer with the retained reference printout. Correspondence and adequate print quality indicate a successful test.

3.4.1.1 AB16-55T3 Vertical Format Tape Preparation/Installation

- **Preparation of Vertical Format Tape for AB16-55T3 Diagnostic Test**

STEP 1 - Obtain a strip of blank Vertical Format Tape about 12 inches long (either 6 LPI or 8 LPI depending on the density commonly used at the site). The tape must be manually punched with the appropriate hand punch. The channel number coding to be used is indicated in Table III.

Table III

Channel Number Coding for Test Tape

Line 1	Channel 1	Head of Form
8	3	
20	4	
29	5	
38	6	
47	7	
61	2	End of Form
67	1	Coincident with Line 1

Starting at the top of the strip at a line with a sprocket hole, write the number 1 on the line as shown in Figure 5. Then, count and label the lines according to Table III (the next numbered line, 8, etc.).

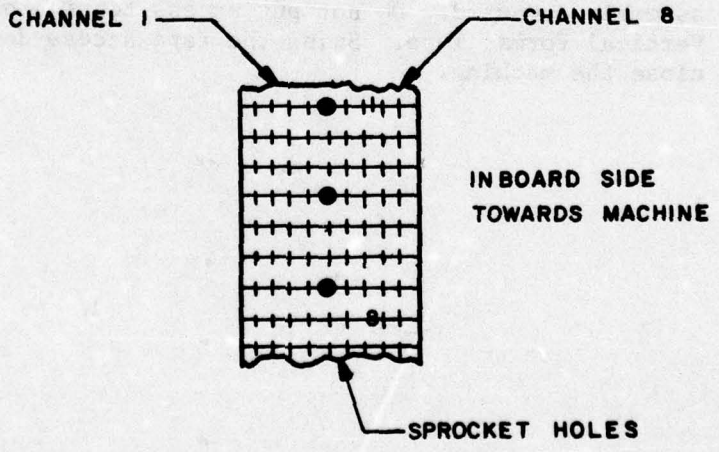

Figure 5. Preparation of Test Tape

STEP 2 - Place the tape in the hand punch such that line 1 can be punched. Punch a hole in channel 1. Advance the tape such that line 8 can be punched. Punch a hole in channel 3. Punch the remainder of the holes according to the table.

STEP 3 - Cut off the extra paper tape about 1/4" before line 1 and 1/4" after line 67. Glue the strip in a loop such that lines 1 and 67 coincide (with the printing on the outside of the loop).

● Installation of AB16-55T3 Diagnostic Test Vertical Format Tape

STEP 1 - Raise the top housing on the Line Printer and open the access door on the left side of the machine at the front. Swing the tape access door down.

STEP 2 - Relax the tension of the tape loop in the machine by gripping the locking lever fingers on either side of the H-shaped Bar Slide assembly and moving the assembly upward. (See Figure 6.) Disengage the operational Vertical Format tape loop from the Upper Sprocket Roller and slide the loop out.

STEP 3 - Insert the diagnostic test Vertical Format tape loop over the Upper Sprocket Roller engaging the sprocket pins and insuring that the tape is routed between the papertape guide and the phototransistor diode assembly. Slip the bottom of the loop over the Lower Sprocket Wheel and gently increase the tension on the loop by gripping the Locking Lever fingers on the Bar Slide Assembly and moving the assembly downward. Do not put excess tension on the Vertical Format Tape. Swing the tape access door up and close the machine.

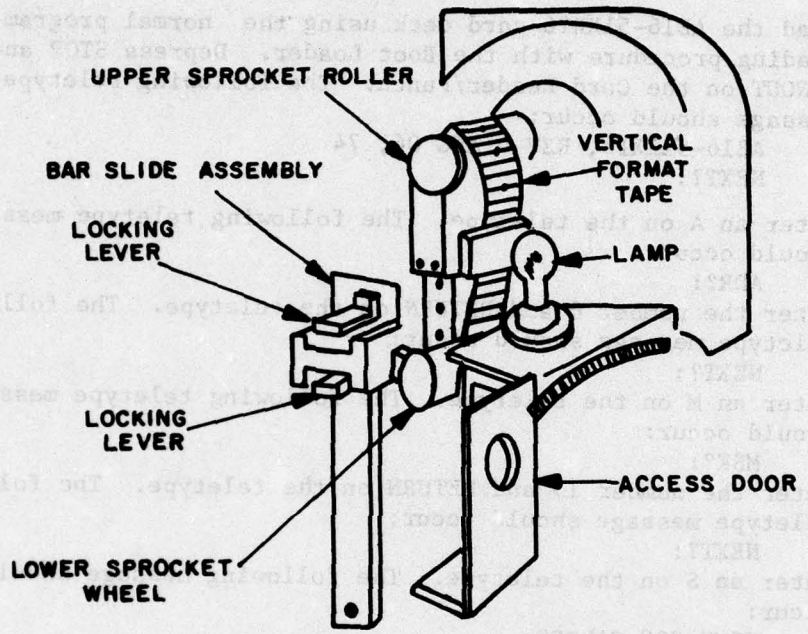

Figure 6. Installation of Vertical Format Tape on Line Printer

3.5 Card Reader/Punch Procedures

3.5.1 700-5140 Card Reader/Punch Subsystem

3.5.1.1 Procedure - Card Deck Input Source

STEP 1 - Load the AB16-51XXT6 card deck using the normal program loading procedure with the Boot Loader. Depress STOP and RUNOUT on the Card Reader/Punch. The following teletype message should occur:

```
AB16-51XXT6, REV D AUG 06, 74
NEXT?:
```

STEP 2 - Enter an A on the teletype. The following teletype message should occur:

```
ADR?:
```

Enter the number 6 and RETURN on the teletype. The following teletype message should occur:

```
NEXT?:
```

Enter an M on the teletype. The following teletype message should occur:

```
MSK?:
```

Enter the number 13 and RETURN on the teletype. The following teletype message should occur:

```
NEXT?:
```

Enter an S on the teletype. The following message should occur:

```
TIME 200 CARDS?:
```

Enter a Y on the teletype.
In the following steps all references to STOP, RUNOUT and START apply to the Card Reader/Punch Switches. Figure 7 contains a description of the input and output test decks.

STEP 3 - Place a deck of <u>at least</u> 200 blank cards in the input hopper. Press START, noting the time to the second when the first card is read. Note the time to the second when the last card is read. The elapsed time should be between 27 and 33 seconds. Depress STOP and RUNOUT. The following teletype message should occur:

```
TIME OK?:
```

Enter a Y on the teletype. The following message should occur:

```
OK
NEXT?:
```

Enter an H on the teletype.
The following teletype message should occur:

```
RUNOUT
```

Card Reader Test

Hollerith Test Deck (STEP 4)

4 Blank Cards

1 Card punched per HSB table

1 Card, Col. 1 11-8-6 Col. 2, 1-2

52 Blank Cards

Random Card Deck (STEP 6) - 200 Cards

AA16-51XXT6 Deck (64 Cards)

10 Cards punched per HSB table

RCP-7XX Deck (n cards)

10 Cards punched per HSB table

Blank cards to fill out a total of 200

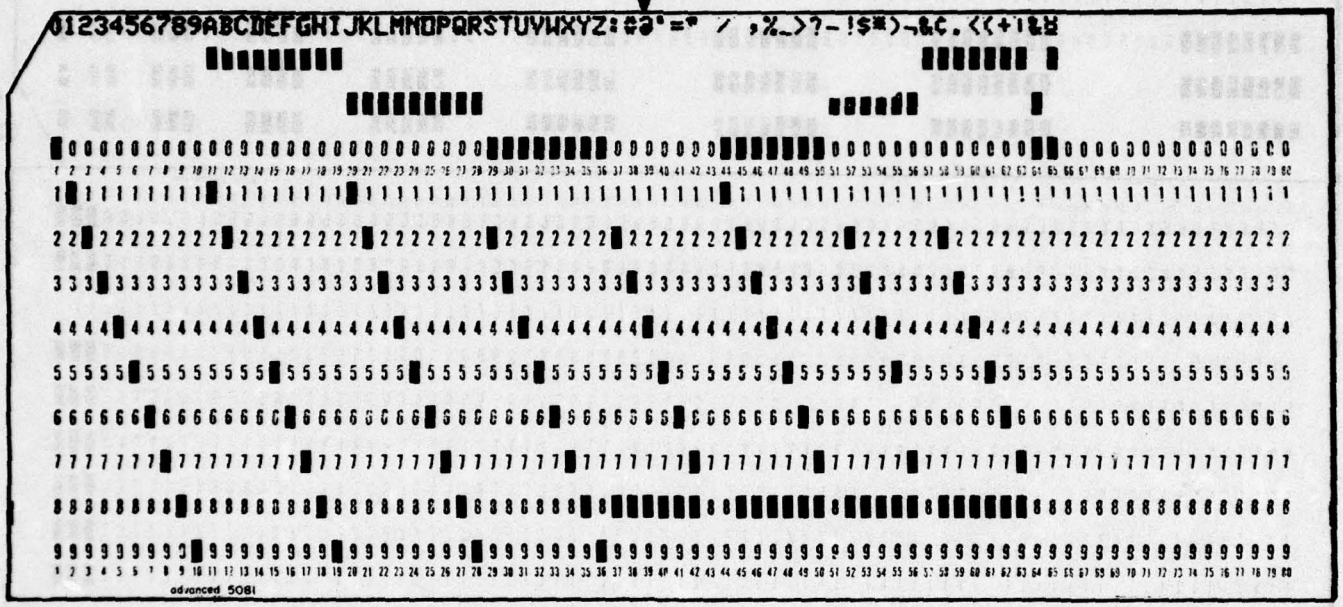

Figure 7. Typical Test Cards

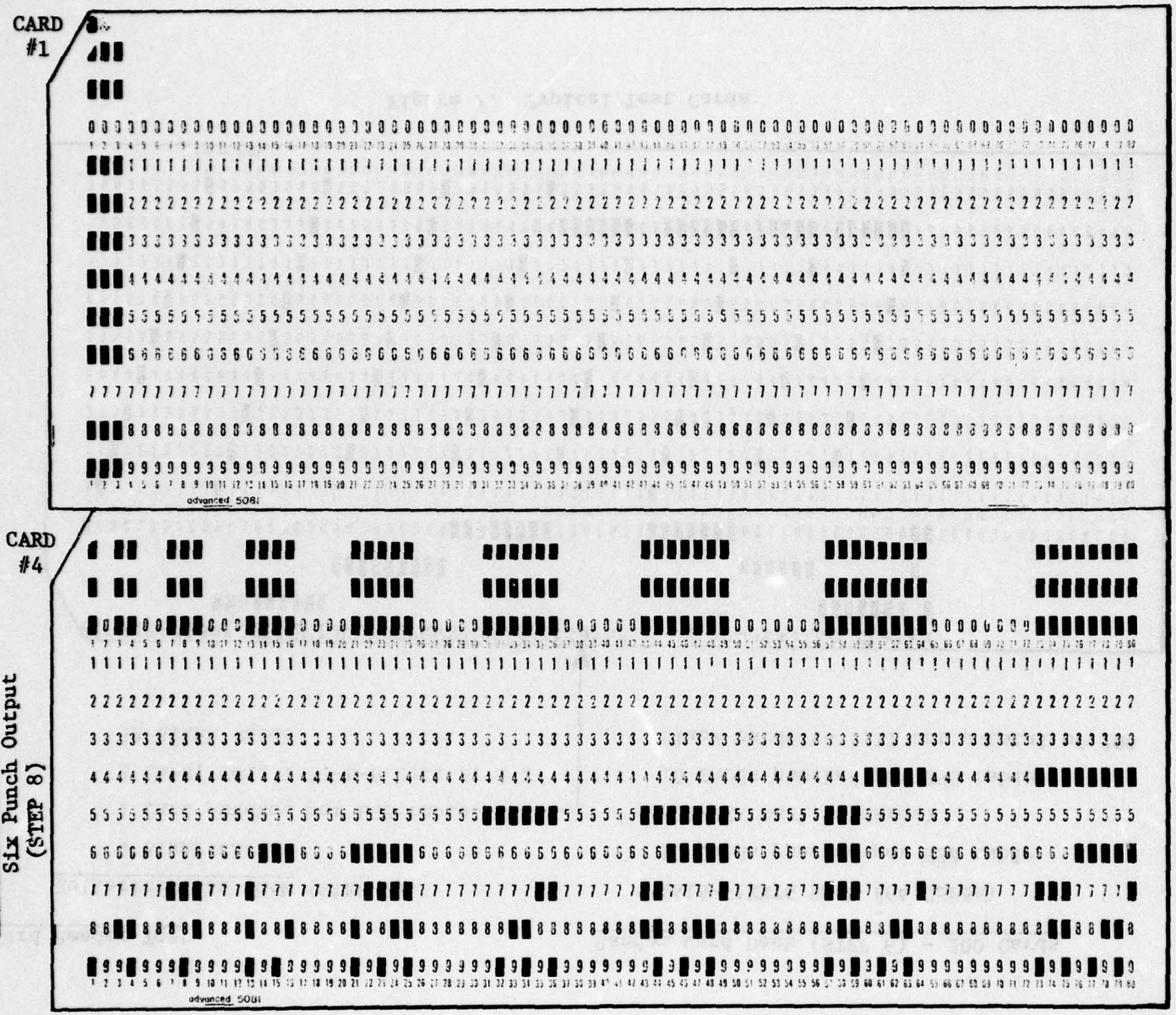

Figure 7. Typical Test Cards (Concluded)

STEP 4 - Place the Holerith Test Deck in the input hopper and press START. A card should be read and the following teletype message output:

RUNOUT

Depress STOP and RUNOUT. After the card is ejected, depress START. Two more cards should be read, the RECHECK indicator should be illuminated, and the following message should occur:

OK
RUNOUT

Depress STOP and RUNOUT. After the cards are ejected, depress START. Four more cards should be read and two ejected. The RECHECK and VALIDITY indicators should be illuminated. The following teletype message should occur:

OK
RUNOUT

Depress STOP and RUNOUT. After the two cards are ejected, depress START. The remainder of the deck will be read. Depress RUNOUT. The following teletype message should occur:

OK
OFFSTK OK?:

Verify that only the following cards are offset in the output hopper: 1, 3, 4, 7, 8, and the last card. Enter a Y on the teletype. The following teletype message should occur:

OK
NEXT?:

Enter a D on the teletype. The following teletype message should occur:

DECKSIZE NOT TO EXCEED 659 CARDS
?:

Enter the number 200 and RETURN on the teletype. The following teletype message should occur:

NEXT?:

STEP 5 - Enter an R on the teletype. The program will cause a carriage return on the teletype. Place the Random Card Deck in the input hopper. Depress START. The deck should be read. Depress STOP and RUNOUT. The following teletype message should occur:

NEXT?:

Enter a V on the teletype. The following teletype message should occur:

FULL CHECK?:

Enter a Y on the teletype. The following teletype message should occur:

RAN.DLY?:

Enter a Y on the teletype. The program will cause a carriage return to occur on the teletype.

STEP 6 - Remove the Random Card Deck from the output hopper. Replace the first card of the deck with a blank card and place the deck in the input hopper. Depress START. The first card should be read followed by the teletype message:

CRD NO. 1 - BITS D-98
ROW - 9, 8, 7, 6, 5, 4, 3, 2,
COL - 1, 10, 13, 16, 18, 20, 21, 24, 25, 38

The remainder of the deck should then be read but at an irregular rate followed by the teletype message:

NEXT?:

Depress STOP and RUNOUT. Enter a V on the teletype. The following teletype message should occur:

FULL CHECK?:

Enter a Y on the teletype. The following teletype message should occur:

RAN.DLY?:

Enter an N on the teletype. The program will cause a carriage return to occur on the teletype.

STEP 7 - Remove the Random Card Deck from the output hopper and replace the first card (blank) with the original card. Place the Random Card Deck in the input hopper and depress START. The deck should be read at an even rate followed by the teletype printout:

NEXT?:

Depress STOP and RUNOUT and remove the Random Card Deck from the output hopper. The Card Reader test is now completed; to test the Card Punch, continue.

STEP 8 - Load the input hopper of the Card Reader/Punch with <u>at least</u> 206 Blank cards. Enter a P on the teletype. The following teletype message should occur:

RUNOUT

Depress RUNOUT and START. A card should be punched and output; the RECHECK indicator on the Card Reader/Punch should be illuminated; and the following teletype message should occur:

OK
RUNOUT

Depress STOP and RUNOUT. Two blank cards should be output. Depress START. A card should be punched and output and the following teletype message should occur:

OK
TIME 200 CARDS?:

Depress STOP and RUNOUT: two more blank cards should be output. Remove the cards in the output hopper. Cards 1 and 4 should be duplicates of the standard cards shown in Figure 7. Cards 2, 3, 5, and 6 should be blanks.

STEP 9 - Enter a Y on the teletype. Depress START and note the time to the second when the first card is punched (this occurs almost simultaneously with the START depression). Note the time to the second when the last card is punched. The elapsed time should be between 68 and 82 seconds. The following teletype message should be output:

TIME OK?:

Enter a Y on the teletype. The following teletype message should occur:

OK
RUNOUT-REMOVE STACK

Depress STOP and RUNOUT and remove the punched deck, which should consist of 200 cards punched all rows in columns 37-44.

3.5.1.2 Procedure - Paper Tape Input Sources

STEP 1 - Initialize the CPU with the following Key-In Loader using the TERMINAL INITIALIZATION procedure:

Y-Address	Contents (octal)
1	010057
2	030004
3	131004
4	002003
5	101040
6	002003
7	010000
10	131004
11	002010
12	041470
13	130004
14	002013
15	110000
16	024000
17	100040

STEP 2 - All switches level on the CPU. Depress MASTER CLEAR Key-in Y = '00001. Install the paper tape (containing the diagnostic program) in the read-head of the teletype. Depress START on the CPU and the START switch on the teletype paper tape reader. The tape loads in about 30 minutes. The teletype output during the read-in process is unintelligible.

STEP 3 - All switches level on the CPU. Depress MASTER CLEAR. Key-in '01000. Depress STOP/RUN to RUN. Depress START. The following teletype message should occur:

AB16-51XXT6, REV D AUG 06, 74
NEXT?:

STEP 4 - Enter an A on the teletype. The following teletype message should occur:

ADR?:

Enter the number 6 and RETURN on the teletype. The following teletype message should occur:

NEXT?:

Enter an M on the teletype. The following teletype message should occur:

MSK?:

Enter the number 13 and RETURN on the teletype. The following teletype message should occur:

NEXT?:

Enter an S on the teletype. The following message should occur:

TIME 200 CARDS?:

Enter a Y on the teletype.

In the following steps all references to STOP, RUNOUT and START apply to the Card Reader/Punch switches.

Figure 7 contains a description of the input and output test decks.

STEP 5 - Place a deck of <u>at least</u> 200 blank cards in the input hopper. Press START, noting the time to the second when the first card is read. Note the time to the second when the last card is read. The elapsed time should be between 27 and 33 seconds. Depress STOP and RUNOUT. The following teletype message should occur:

TIME OK?:

Enter a Y on the teletype. The following teletype message should occur:

OK
NEXT?:

Enter an H on the teletype
The following teletype message should occur:

RUNOUT

STEP 6 - Place the Holerith Test Deck in the input hopper and press START. A card should be read and the following teletype message output:

RUNOUT

Depress STOP and RUNOUT. After the card is ejected, depress START. Two more cards should be read. The RECHECK indicator should be illuminated, and the following teletype message should occur:

OK
RUNOUT

Depress STOP and RUNOUT. After the cards are ejected, depress START. Four more cards should be read and two ejected. The RECHECK and VALIDITY indicators should be illuminated. The following teletype message should occur:

OK
RUNOUT

Depress STOP and RUNOUT. After the other two cards are ejected, depress START. The remainder of the deck will be read. Depress RUNOUT. The following teletype message should occur:

OK
OFFSTK OK?:

Verify that only the following cards are offset in the output hopper: 1, 3, 4, 7, 8, and the last card. Enter a Y on the teletype. The following teletype message should occur:

OK
NEXT?:

Enter a D on the teletype. The following teletype message should occur:

DECKSIZE NOT TO EXCEED 659 CARDS
?:

Enter the number 200 and RETURN on the teletype. The following teletype message should occur:

NEXT?:

STEP 7 - Enter an R on the teletype. The program will cause a carriage return on the teletype. Place the Random Card Deck in the input hopper. Depress START. The deck should be read. Depress STOP and RUNOUT. The following teletype message should occur:

NEXT?:

Enter a V on the teletype. The following teletype message should occur:

FULL CHECK?:

Enter a Y on the teletype. The following teletype message should occur:

RAN.DLY?:

Enter a Y on the teletype. The program will cause a carriage return to occur on the teletype.

STEP 8 - Remove the Random Card Deck from the output hopper. Replace the first card of the deck with a blank card and place the deck in the input hopper. Depress START. The first card should be read followed by the teletype message:

CARD NO. 1 - BITS D-98
ROW - 9, 8, 7, 6, 5, 4, 3, 2,
COL - 1, 10, 13, 16, 18, 20, 21, 24, 25, 38

The remainder of the deck should then be read but at an irregular rate followed by the teletype message:

NEXT?:

Depress STOP and RUNOUT. Enter a V on the teletype. The following teletype message should occur:

FULL CHECK?:

Enter a Y on the teletype. The following teletype message should occur:

RAN.DLY?:

Enter an N on the teletype. The program will cause a carriage return to occur on the teletype.

STEP 9 - Remove the Random Card Deck from the output hopper and replace the first card (blank) with the original card. Place the Random Card Deck in the input hopper and depress START. The deck should be read at an even rate followed by the teletype printout:

NEXT?:

Depress STOP and RUNOUT and remove the Random Card Deck from output hopper. The Card Reader test is now completed; to test the Card Punch, continue.

STEP 10 - Load the input hopper of the Card Reader/Punch with <u>at least</u> 206 Blank cards. Enter a P on the teletype. The following teletype message should occur:

RUNOUT

Depress RUNOUT and START. A card should be punched and output; the RECHECK indicator on the Card/Reader Punch should be illuminated, and the following teletype message should occur:

OK
RUNOUT

Depress STOP and RUNOUT. Two blank cards should be output. Depress START. A card should be punched and output and the following teletype message should occur:

OK
TIME 200 CARDS?:

Depress STOP and RUNOUT. Two more blank cards should be output. Remove the cards in the output hopper. Cards 1 and 4 should be duplicates of the standard cards shown in Figure 7. Cards 2, 3, 5, and 6 should be blanks.

STEP 11 - Enter a Y on the teletype. Depress START and note the time to the second when the first card is punched (this occurs almost simultaneously with the START depression). Note the time to the second when the last card is punched. The elapsed time should be between 68 and 82 seconds. The following teletype message should be output:

TIME OK?:

Enter a Y on the teletype. The following teletype message should occur:

OK
RUNOUT REMOTE STACK

Depress STOP and RUNOUT and remove the punched deck, which should consist of 200 cards punched all rows in columns 37-44.

STEP 12 - Reinitialize the CPU with the operational Key-In Loader using the TERMINAL INITIALIZATION procedure. The Card Reader/Punch diagnostic test (paper tape source) is now complete.

3.6 Communications Controller Subsystems

3.6.1 700-6312 Synchronous Single Line Controller

STEP 1 - Depress Sense Switch 4 on the CPU. Load the AA16-6312T3 card deck using the normal program-loading procedure with the Boot Loader.
This teletype message should occur:

```
AA16-6312T3 SSLC TEST REV. A 6-29-73
COMMAND LIST:
A=AUTO TST
C=DEV ADRS
D=DEBUG
  C=CONFIG
  D=DATA
  I=IDNTFY
  L=LP TST
  N=NON-LP TST
  Q=QUIT
S=SUBTST
  DA  CID  CODE
  60  231   8 BIT CRTS
```

STEP 2 - Enter the number 60 and a RETURN on the teletype. The following teletype message should occur:

```
NEXT?:
```

STEP 3 - Enter an A on the teletype. An SSLC test should occur and cause the following teletype message in about 3 seconds:

```
PASS 0000001 DA=60 ERRORS=0000
NEXT?:
```

Any other output indicates an SSLC failure.

STEP 4 - Enter a D on the teletype. The following teletype message should occur:

```
DBG?
```

Enter a D on the teletype. The following teletype message should occur:

```
DATA?:
```

Enter the number 123456 on the teletype followed by a CARRIAGE RETURN. The following teletype message should occur:

```
DATA?:
```

Depress CARRIAGE RETURN. The following teletype message should occur:

```
DBG?:
```

STEP 5 - The program is now initialized to execute a loopback test on the remote communications link at any point where the transmit and receive lines are interconnected. This can be at a remote modem with a digital loopback switch, a multiplexor with loopback capability, or at a terminal board with manual interconnection. The characteristics of each communications link should be determined and the appropriate instructions added to this procedure to accomplish the desired loopback. In most cases, the first loopback will be at the remote modem.

STEP 6 - Enter an N on the teletype. A test message will be sent from the H700 (SSLC) over the communications link to the loopback point and back in several seconds. The program will verify correct message receipt which will be indicated by the same teletype message as output in STEP 3. Any other output indicates an error condition. This step should be repeated for each loopback point. After the completion of this test, all modem switches, etc., should be returned to their normal operating positions.

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Synchronous Single Line Controller Test (4K)	AA16-6312T3	Rev. A	70186127000	June 29, 1973

*Obtainable from

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